# Automatic Pilot Mode during Abnormality for an Automobile

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## ABSTRACT
As per the statistics, there is a death every six minutes in India due to road accidents. This is expected to rise to one every three minutes by the year 2020. To avoid this, many innovations are needed in the field of automotive safety. This document proposes a system that assumes automatic control of a four-wheeler in case of a medical emergency – particularly during a cardiac arrest to the driver – and steers the vehicle to safety.

## Keywords
Microphone, Voice recognition system, CAN, Cruise control, Image sensor

## 1. INTRODUCTION
Road accidents have been on a rise in the last few years. Recent statistics indicate that in India, 1.2 lakh people die and 12.7 lakhs get seriously injured due to road accidents every year. Although India accounts for only one percent of the registered motor vehicles worldwide, it contributes to ten percent of the road accidents every year. Improvement in general lifestyle has contributed to a rise in the amount of cars. The number of accidents has increased proportionally, particularly those involving medical conditions.

A study by Dr.Julian A. Waller on “Traffic Accidents – Chronic Medical Conditions as a Cause” states that fifteen per cent of the road accidents involve chronic medical conditions (excluding alcoholism). However, this study was carried out in California. The situation is more critical in India as people suffer from heart disease and diabetics by the dozen. It is estimated that 4.5 crore people suffer from coronary heart disease and at least 5 crores suffer from diabetics. This creates a need for a system which can bring down accidents in such cases. Despite lots of upgrades in automobile safety, there is no system in place to ensure this. A mechanism which can trigger a set of events to ensure safety upon an action from the driver is one of the solutions. A system which acts upon a keyword uttered by the driver would serve the purpose. This is the main objective of the paper.

## 2. MAIN CONCEPT
This system recognizes a pre-programmed audio (voice) keyword of the driver’s choice. When the voice-recognition system detects the keyword, automatic control of the automobile is assumed. The left indicator flashes by virtue of the inbuilt mechanism and the vehicle gradually starts slowing. A siren goes off to alert the other vehicles on the road. Some vehicle owners might even stop to help the driver in such a case. A sensor at the back scans for any vehicle approaching at a short distance. When there’s no threat, the vehicle pulls over to the left end of the road. The system then alerts the nearest emergency service control room (108) through the global service for mobile (GSM) technology. The vehicle’s GPS co-ordinates are then sent to the control room which facilitates the emergency service to reach the place as soon as possible.

There is a possibility of a false alarm going off in this system. In such a case, it would be ideal if there is a button within the driver’s reach which can bring the control back to the driver. The placing of the button should ensure that it doesn’t get depressed accidentally when the driver is suffering from a heart attack. Placing the button near the window is suggested as it satisfies all the conditions.

## 3. SYSTEM ARCHITECTURE
Before jumping to the system architecture, it would be better if the flow of the system proposed is understood. The following flow chart shown in figure 1 can be referred for the better understanding of the proposed concept.

1. The ignition of the automobile should be turned on to initiate the working of the system

2. As soon as the ignition is ON, the voice recognition and noise filter systems along with heart rate and blood pressure sensors are automatically enabled

3. The heartbeat of the driver is sensed continuously by the sensors placed in the driver seat. All sounds inside the car are also continuously monitored.

4. This process continues until either the keyword is uttered by the driver or the heartbeat of the driver becomes abnormal. Usually the heartbeat of a person stops when he sneezes or gets altered if the person has a coughing fit. In such cases, the system might get activated. To prevent such abnormalities from occurring, a thirty second window is provided by the system. If the driver pushes a button within these thirty seconds, the system gets deactivated and the driver resumes full control of the automobile.

5. In case the driver’s heartbeat becomes abnormal or in case the keyword is uttered, the manual controls of the automobile like the steering, brake, clutch and accelerator control systems are overridden and the proposed system assumes full control

of the car. This is done by using the CAN bus. The left indicator of the vehicle is flicked ON and an alarm is sounded so as to denote medical emergency. This helps the other vehicles which are in the vicinity of the test vehicle to move away.

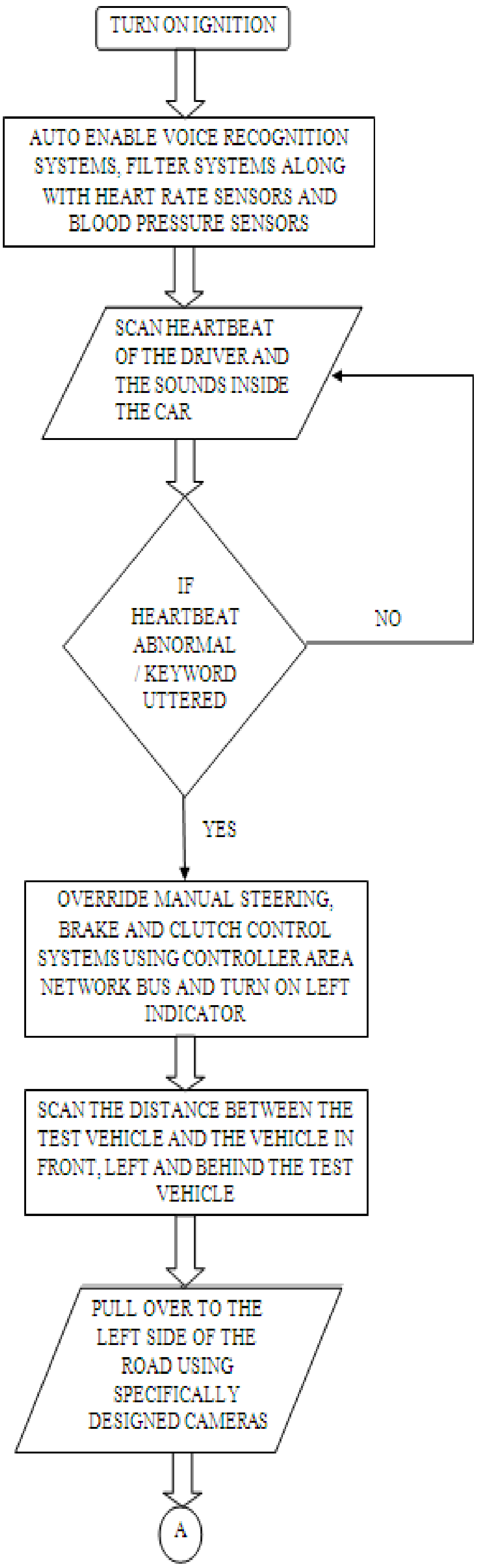
6. The distance between the test vehicle and the vehicles in front of, to the left of and behind the test vehicle is calculated using IR photoelectric sensor and the car pulls over to the left side of the road accordingly. This is done to prevent accidents which might occur if the car suddenly stops in the middle of a road.

7. The edge of the road is sensed by a camera which is placed on the front left end of the car or below the front left door.

8. The vehicle halts in the left end of the road and the nearest police and medical emergency control stations are alerted using AVLS (Automatic Vehicle Location System). This sends the GPS co-ordinates of the automobile to these control stations.

9. Before killing the engine, the windows of the automobile are opened in order to prevent suffocation to the driver and also to facilitate easy breathing.

10. After all these steps are complete, the ignition is killed.



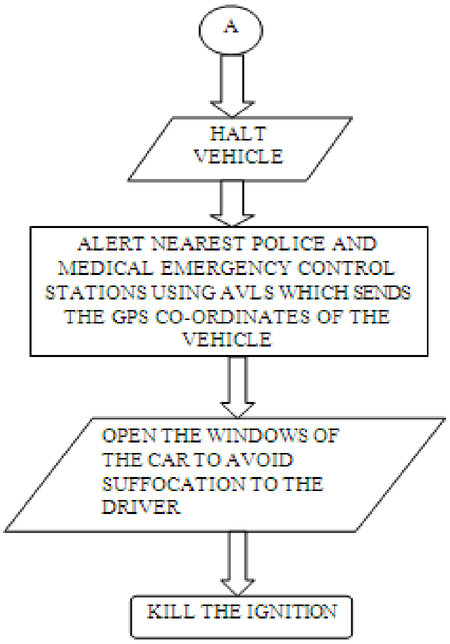



**Fig 1: Flowchart**

The utterance of the keyword is detected by the keyword recognition system. The output of this system is fed to the microcontroller unit as shown in Fig. 2. The microcontroller is interfaced to receive inputs from Controller Area Network (CAN) bus, a Charge-Coupled Device (CCD) image sensor, an infra-red photoelectric sensor and a reset switch. It is also interfaced to provide output to a horn and an Automatic Vehicle Location System (AVLS). The AVLS is connected to the control room (108). CAN bus is generally interfaced to receive signals from various sensors. However, only the signals from cruise control system, steering system, left indicator and windows are significant for this purpose.

After the keyword is recognized by the keyword recognition system, the microcontroller unit is enabled. In turn, the AVLS, the CCD image sensor and the infra-red photoelectric sensor are activated by the microcontroller unit. Using a combination of GPS and GSM technology, the AVLS alerts the control room and also provides information on the location of the vehicle within 30 feet accuracy. The CAN bus is used to control the car as all the control signals of the car is interfaced to it. The left indicator is the dominant node and will start flashing the moment CAN takes control of the vehicle. The cruise control system reduces the speed of the vehicle. The infra-red sensors at the back and at the left of the car scan for the presence of a vehicle. The CAN bus will start controlling the steering system only after there is no threat. A special type of horn will serve as an alarm for the vehicles in the periphery of the car. This will alert those vehicles so that they stay out of the way. The owners of those vehicles might even stop to help. A display at the back to alert other vehicles was thought of initially. But it was rejected as it will definitely distract other drivers. The car is steered to the side of the road according to the output of the image sensor. Windows of the car are opened so as to prevent suffocation.

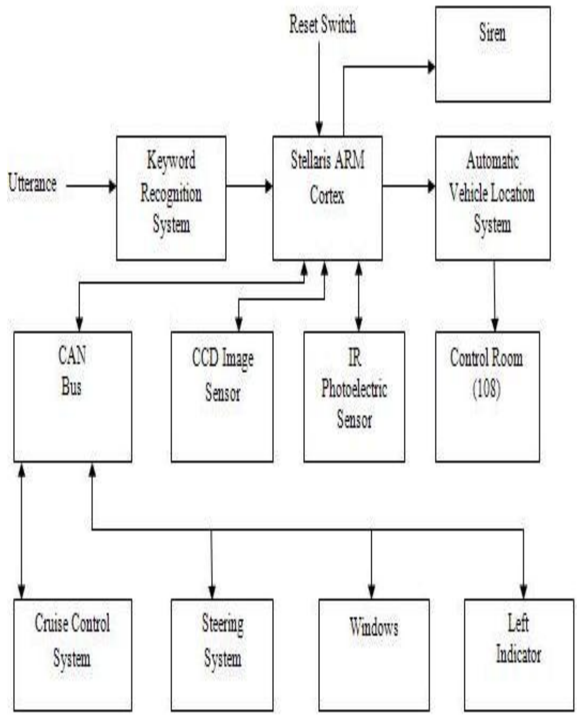



**Fig 2: Overall System Architecture**

## 3.1 Keyword Recognition System

A microphone is in place to detect the keyword uttered by the user. The output of the microphone is fed to an amplifier. The amplifier's output gets filtered by a band-pass filter. The filter output is directed through an A/D converter before reaching the microcontroller unit.

It is essential that the signal is passed through an amplifier since clarity cannot be expected from the car driver in terms of crisis. There is every chance that the driver's voice may be feeble. Band-pass filter is designed so that only frequencies between 3 kHz to 7 kHz are accepted. The frequencies of all human voices fall in this category. This is done to filter out external noise. Dynamic Time Warping (DTW) algorithm is used to compare the uttered keyword against the pre-defined keyword. This is done by the microcontroller unit which is programmed using this algorithm.

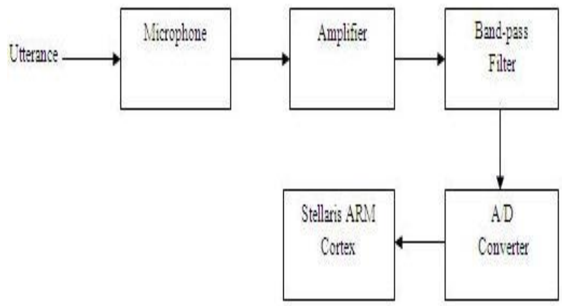



**Fig 3: Keyword Recognition System**

## 3.2 Cruise Control System

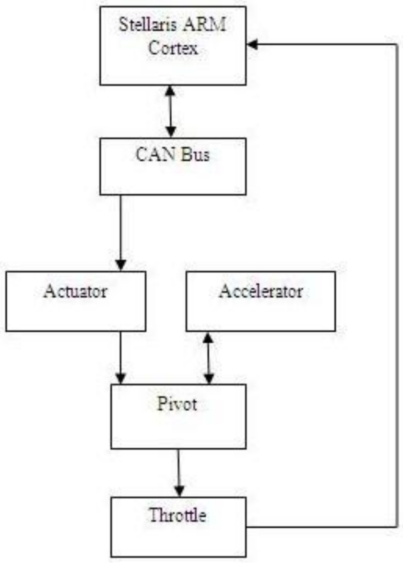



**Fig 4: Cruise Control System**

Cruise control system, as mentioned earlier is used for controlling the speed of the vehicle. The CAN bus is connected to an actuator which is connected to a pivot. The pivot also accepts an input from the accelerator. The pivot is connected to the throttle. The position of the throttle is fed back to the microcontroller unit.

When control of the car is automated, the desired speed set by the microcontroller unit is transmitted to the CAN bus. The throttle position which is fed back to the microcontroller unit is compared against the desired position by the processor. The correction is transmitted to the CAN bus. The bus tries to achieve the desired speed by controlling the actuator which adjusts the position of the throttle through a pivot. The accelerator pedal moves according to the position of the pivot. The position of the throttle is fed back to the bus and the entire procedure is repeated till the desired speed is achieved.

## 3.3 Steering system

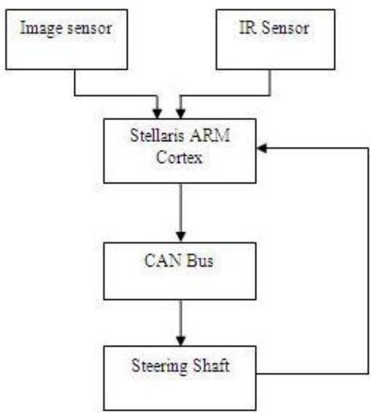



**Fig 5: Steering System**

The automatic control of the steering system is extremely crucial. The car should turn to the left side of the road only after ensuring that there's no threat. This, as mentioned earlier will be taken care of by infra-red sensors. An image sensor is used for the purpose of determining the distance to be travelled to park by the roadside. The sensors are interfaced to the microcontroller unit. The microcontroller unit controls the steering shaft through the CAN bus. The position of the steering shaft is fed back to the microcontroller unit.

The infra-red sensors at the back and at the left of the car scan for the presence of a vehicle. The CAN bus will start controlling the steering system only after there is no threat. The image sensor will identify a change in pattern when it senses the left end of the road. The distance between the left end of the road and the current vehicle position is calculated and is fed to the CAN bus via the microcontroller unit. If the sensor doesn't detect any change in pattern, then the car will travel a preset distance which is half the average width of a road. This is achieved by calculating the angle the steering shaft needs to be rotated by to steer the car to the roadside. The microcontroller does the work and like in the case of the cruise control system, transmits the desired angle of the steering shaft and the correction after receiving feedback to the CAN bus. The bus adjusts the position of the steering shaft and depending on the feedback to the microcontroller unit, repeats the process till the angle is satisfactory.

## 4. OBSERVATIONS

Through the search that we have made, we have come to an understanding that this idea is very novel and we would like to conclude that the system if being made a part of the automobile, accident rates will be reduced. Also, the passenger safety will be increased to a considerable extent. Though it might cost slightly on the higher side, when produced on a large scale it will be affordable by the common man.

## 5. ACKNOWLEDGMENT

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